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CONTENTS

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Requests for membership application blanks and general inquiries concerning the Society should be addressed to Mrs. Mabel Robbins, Secretary, Bronson Museum, 8 North Main Street, Attleboro, Mass. Society dues should be forwarded to Arthur C. Staples, Treasurer, Segreganset, Mass.

The Society maintains a modern, well-equipped museum—THE BRONSON MUSEUM — in the Bronson Building, 8 North Main Street, Attleboro, Mass. Museum hours are from 9 to 5, Mondays, Tuesdays and Thursdays. Special arrangements to accomodate group visitors may be made by contacting the Museum Director, Maurice Robbins, at the Museum address.

All material submitted for publication in the Society Bulletin and the News Letter should be forwarded to Leaman F. Hallett, Editor, 31 West Street, Mansfield, Mass.

A MESSAGE FROM THE PRESIDENT . . . .

As we enter our eighteenth year as a state archaeological society it seems worthwhile to pause a moment to survey our past accomplishments, and to analyze our goals for the future.

In the middle of an atomic era it is somewhat remarkable to discover such a widespread interest in the study of the past as evidenced by our membership growth. From 38 Charter Members in 1939, our membership had reached close to 300 in 1949. We are now over the 600 mark on a fairly constant rate of increase. We have thus more than doubled our membership in seven years. We now have nine Chapters, an increase of three since 1949, and two additional Chapters are being formed.

Each year people bemoan the advance of building and predict the arrival of the day when no further sites will be available for archaeological investigation. Paradoxically perhaps, the last few years have seen active field work done on several new and important sites. Of perhaps most widespread interest are the efforts at the Ipswich fluted point site and the Taunton River and Assawompsett Lake sites. Many of the local Chapters have sites available, and reports on some have been published in our Bulletin.

Three major factors are responsible for the continued and increasing interest in our Society; our publications, our Museum and our organized field efforts. Under the able direction of Maurice Robbins, and the artistic and energetic efforts of Curator William Fowler, our Museum is one of the finest in New England. Our Bulletin has always served as a stimulant to archaeological interest and, with the revival this year of the News Letter, and, it is hoped, the Handbook, more news of local activity will be available.

The coming year promises a great deal of interest for all members. We expect to add the unusual hafted celt to our Museum exhibits, several local Chapters will have organized field work, our capable and hard working program committee promises a stimulating meeting next April, and our own publications will be supplemented by those of the Eastern States Archaeological Federation, in which we have renewed our membership.

Walter A. Vossberg.

RADIOCARBON DATING: A BRIEF APPRAISAL

By Frederick Johnson

The nine years since the announcement of the possibility of dating archaeological remains by means of carbon-14 have been eventful ones. The method has become a firmly established and extremely useful research tool. It is employed in all branches of science investigating organic and other remains containing carbon 40,000 years old or less. It is especially important in fields in which the chronological order of phenomena is of significance.

The effect of imposing a consistent chronology upon American Archaeology has been profound, possibly because this occurred at a time when the science was in the process of taking account of stock and looking to the future. The chronology assisted in the organization of material and the formulation of new problems. Nevertheless, the character of the method and the nature of the resulting dates has been the source of some confusion. The method itself has no relation to archaeological thinking for it involves basic assumptions and data included well within the realms of nuclear physics, geochemistry and geophysics. The results of the method, that is, the numbers, are not at all dates such as one finds in history books. The number of years given is based upon the rate of radioactive decay of carbon-14, one of the isotopes of carbon. The element carbon has three naturally occurring isotopes: carbon-12, carbon-13, and carbon-14. The latter is unstable and disintegrates to form nitrogen. The disintegration is by emission of electrons and these occur as random events which can be recorded in a very sensitive type of Geiger counter. The sensitivity of the apparatus, including the counter, is exemplified by the quantity of carbon-14 with which it works. In living wood, for example, carbon-14 consists of but .000,000,000,017% of the isotopic composition of the carbon in that wood.

The method and the interpretation of its results have been the source of many scientific and popular papers, some of which leave much to be desired. Largely because it is new and also because it is not yet developed to its final stage, there has been considerable misunderstanding by those who have not thoroughly investigated the way in which the method works and what the results mean. These misunderstandings have led sometimes to confusion and occasionally to outright error. At the risk of adding to this, the following is a review of some of the salient points in the present situation. It is hoped that some measure of the breadth and utility of the method is outlined or implied here. Accompanying this, there is some description of the important qualifications concerning its use.

In discussing the character of the method and what it can do it is wise to re-emphasize a fundamental point of view. It is important to remember that archaeology is based upon an assemblage of basic data and theory, the integrity of which is unassailable. The same is true of nuclear physics and any other scientific field. It is equally important to recognize that these scientific fields are not descrete compartments and data in one field may compliment information in another. Given such circumstances, mutual progress can only be gained by honest collaboration. This often results in the improvement of basic hypotheses or theory in the fields involved. It is just as important for physicists to realize that data from a clear-cut stratigraphic sequence indicates its order in time as it is for an archaeologist to recognize that a carbon-14 date is actually a number representing the recording of random radiations of an unstable isotope of carbon.

In 1948 Dr. W. F. Libby, then at the University of Chicago, discussed the promising results of his brilliant research with a group of archaeologists. He and his associates had discovered that carbon-14 an isotope of carbon which they named radiocarbon, had properties which could be used in dating samples composed of organic materials. The primary knowledge of these properties made possible postulation of a curve on a graph on which measured quantities of radiocarbon in samples were plotted in relation to the number of years elapsed since their death. In order to calibrate the extremely delicate apparatus and to test the accuracy of the curve, archaeologists were requested to supply for age determination samples of known age, preferably 4000 to 5000 years old.

The task undertaken by a committee appointed to advise Libby was a most exciting one. At the time there was some question whether or not the method could actually be made to function in the way it was assumed that it should. Also, archaeology, and geology which was soon represented, had to consider chronology in a new light. In effect, the work of the committee was to set the stage for a collaboration among scientific fields. The nature of this particular endeavor was practically without precedent. This collaboration has been furthered by conferences in Copenhagen, Denmark; Cambridge, England; and two meetings in Andover, Massachusetts. These and numerous publications have outlined the basic nature of the research and its expansion into a number of scientific fields. It is now clear that archaeology, geology, oceanography and biology, to name a few of the fields involved, have been provided with an extremely useful tool. Research into the nature of radiocarbon and all it involves continues; as yet the method is not stabilized. For example, originally 20,000 to 25,000 years was the limit of the age which could be determined by the "solid carbon" method. A short while ago, by converting to "gas counting", the limit was raised to 30,000 to 35,000 years. Rather recently a laboratory in Holland has refined the technique so to date samples more than 40,000 years old. Paralleling this progress has been general improvement of the instrumentation in order to increase the precision of measurement and to add to the speed and reduce the cost of the operation. It is true also that we are becoming wiser in the manner of applying the results. In learning to appreciate clearly what the dates mean, we have acquired a much better understanding of the chronology of many geologic events in the northern hemisphere during the Pleistocene and of episodes in the development of human culture throughout the world during the past 40,000 years.

Since the beginning of modern science much research has been devoted to the development of ways of counting time. The character and precision of these methods has varied widely, especially in the earth sciences, including archaeology. Precision is not as crucial for the older epochs of geologic time as it is for the Pleistocene. This "ice age", as it is sometimes called, saw repeated advances and retreats of glacial ice in northern North America and in the Rocky Mountain region. These movements of ice were accompanied by periodic fluctuations of climate over the whole of the continent. All these factors, especially during the recent past are responsible for the character of the deposits comprising the present surface of the earth. Until the radiocarbon method came on the scene, estimates of relative age of points in the climatic fluctuations and glacial regimen have varied greatly because they have been based on different opinions concerning the age of specific phenomena. The counting of varves, that is, the succession of coarse and fine materials deposited in lakes during summers and winters, or the interpolations of rates of ice advance and retreat, erosional cycles, and other processes have all been used to substantiate guesses as to age which may vary as much as 10,000 years or, as some have put it, plus or minus 30 percent.

The need for precision in archaeological chronology has been much greater largely because sequent features in the development of human culture usually merge into one another so that often chronological determination is the only real way of distinguishing them. Some accurate methods of counting time have been developed. For example, the tree ring method serves some sections of North America. This and other precise methods are limited in their usefulness both geographically and in terms of years. In regions where precise methods could not be applied, archaeologists have had to rely for their chronology on educated guesses. These vary in accuracy with the properties of the measure of time applied. By systems of comparison and with assumptions as to the speed of culture processes, the rate of growth of deposits, and so on, estimates of the relative timing of archaeological events have been made. Although chronologies of this sort have some validity, especially in regard to the sequence of materials which is demonstrated, the dates postulated cannot be substantiated. Because of this, different ways of interpreting cultural phenomena have produced different and unprovable estimates of time. In this way has developed the confusion existing especially in the archaeology of eastern North America.

Although the results of the radiocarbon method are not yet perfect, the difficulties are of an entirely different order than those mentioned above. A properly determined date is consistent with other similarly derived numbers and is not dependent upon complicated comparisons and estimates. In other words, the radiocarbon chronology consisting presently of nearly 3,000 dates, is worldwide in its scope and application. All the dates are directly comparable. Dates on layers in New England sites can be compared with dates from New York State, the Middle West or California without interpolations dictated by specialized local conditions. This property alone has figured significantly in some of the important recent progress in American Archaeology.

There are a number of descriptions of the method by scientists who have been doing the difficult and precise laboratory work. The latest of these was written especially for archaeologists by W. S. Broecker and J. L. Kulp[1] and is one of the principle sources for the general description in this discussion. Very briefly, the nuclei of carbon-14, in the process of disintegrating emit electrons at a constant rate. This rate of disintegration is expressed in terms of the "half life" which has been measured as 5568 ± 30 years. This means that at the end of this length of time only half of a given number of carbon-14 atoms will be present. At the end of 11,136 years only one-quarter of the original number of atoms will be left, and so on. The confusing thing about this is that carbon-14 is continuously being formed in the upper atmosphere, above 30,000 feet. The rate of formation is equal to the rate of decay and so the actual amount of radiocarbon in the universe (atmosphere, biosphere, hydrosphere) remains constant.

The newly formed carbon-14 rapidly becomes mixed with all other carbon and it enters the carbon cycle quickly combining with oxygen to form carbon dioxide. Because carbon dioxide is absorbed by plants and because animals feed on plants, or on other animals which have eaten plants, carbon-14 is found in all living matter. The amount to be found in living plants and animals is the same, proportionately, as that in the atmosphere and the sea. When an organism dies, ingestion of carbon dioxide stops and the quantity of carbon-14 becomes reduced by radioactive decay at the rate of one-half every 5568 years. Therefore, if the amount of carbon-14 in a dead organism is found to be one-half of that of living matter, the time of death of the organism can be estimated to be about 5568 years ago.

The measurement of the amount of carbon-14 in a sample is done by counting the radioactive emissions in a specially built and very sensitive Geiger counter. Originally, Libby reduced the sample to pure carbon and deposited this on the inside of walls of a steel cylinder which was placed in the counter. This is called the "solid carbon" method. "Gas counting" has been recently developed and found to be more sensitive. The sample is converted to a carbon-bearing gas such as carbon dioxide, acetylene, or methane and inserted in the counter in this form. It is important to remember that the electron carbon-14 emits, when it decays to become nitrogen, is extremely weak and that it lacks penetrating power. This emission takes place in the presence of extraneous radiation such as that caused by cosmic ray flux, and uranium which is present in minute quantities in all rocks and minerals. In order to separate carbon-14 radiations from the other, frequently stronger "background" emissions, it is necessary to cover the Geiger counter with an iron shield at least eight inches thick and to arrange a complicated electronic counting mechanism in order to cancel other radiations which come through.

This very brief and barely adequate description emphasizes the delicate nature of the measurement. In view of this it is hardly necessary to point out that the sample must be carefully and properly collected and that all the characteristics of the surrounding environment must be meticulously recorded. It is impossible, as some have found, to secure a satisfactory date on samples which have not been properly collected. In the event that the record of collection may be found to be unsatisfactory, it is impossible to apply any kind of correction to the date determined. The date depends upon the detection of the quantity of carbon-14 in the sample and after this has been done it cannot be modified by interpolation of observations concerning the location of the sample. The only way to correct errors due to mistakes in collecting is to return to a site and collect a new sample more carefully.

One important feature of the radiocarbon method which must be thoroughly understood is the sources of error. The largest of these is the error in measurement. However, equally important are errors in the assumptions on which the method is based. It is difficult to prove that the production of carbon-14 by cosmic ray flux has been constant for the past 40,000 years or more. A study of the dates on samples of known age indicates that this flux has changed very little during the past 5,000 years and that no drastic modification has taken place during the past 25,000 years. It does not appear to be likely, but calculations have shown that even if the intensity of cosmic ray flux had increased by as much as 50%, this would have relatively little effect on the radiocarbon age of samples more than 20,000 years old.

It has been found that carbon-14, wherever it exists, in the air, ocean, plants, shells, animals, and so on, is constant in quantity, varying only about 3%. The most important exception to this is the content of organisms which grow in environments such as

1. Broecker, W. S. and J. L. Kulp, "The Radiocarbon Method of Age Determination," *American Antiquity*, Vol. 22, pp. 1-11, July, 1956. cf. Also Libby, W. F. *Radiocarbon Dating*, 2nd ed. Chicago University Press, 1955.

hard-water lakes or on limestone where they can absorb carbonates which are so old that the carbon-14 has decayed to a point where it is virtually absent. This situation can be responsible for an error in the dates as high as 20%. For example, a sample 500 years old might have a carbon-14 age of 2300 years. Fortunately, conditions producing such errors are not common and, furthermore, they are easily detectable provided the collector includes adequate description of the location of the sample. There are other sources of error such as alteration of the concentration of carbon-14 in a sample by replacement, exchange, or the intrusion of "dead" or modern carbonates, and by means of fractionation. The latter can take place, for example, during bacterial decay where an organism selectively eats more of one carbon isotope such as carbon-14, than another, such as carbon-12 or carbon-13. However, the possible effect of fractionation can be determined readily. These processes resulting in possible errors have been the subject of much laboratory investigation and their possible effect upon the dates is either known to be negligible or it can be corrected. A few of the erroneous dates are, however, rather important and interesting exceptions requiring further study. The existence of the latter and some uncertainty concerning the basic assumptions give rise to questions which cannot yet be completely answered. This is usual in any scientific endeavor where hypotheses and postulates serve as the basis for investigation which gradually establishes the validity or alters the original ideas. So often, in science, a brilliant discovery such as this dating method, is the result of stubborn determination accompanying patient analysis and logical correction of mistakes during a long period of research.

The source of the error in measurement is found in the fact that the emissions of electrons which take place when carbon-14 decays to become nitrogen are random events which are subject to known errors in counting. These errors can be expressed statistically. The classic statistical example is picking marbles of different colors out of a barrel. As more marbles are taken, there is an increase in the certainty of predicting the relative number of different colored marbles there are in the barrel. Dr. James Arnold has described the statistics involved in the recording of radiocarbon dates for archaeologists. "If a date is given as, say, 2,400±200 years this means that *from the evidence of the measurements alone*, the chance is 68% that the true value is between 2,200 and 2,600 years. If we consider the range covered as double the error, or 2 sigma, that is, 2,000 to 2,800 years, the chance of the true value being beyond the limits is only 4.5% . . . "

It should be emphasized that quoting a radiocarbon date as a number of years with a plus or minus value there is involved a well tested and securely established principle of statistics which cannot be tampered with. It is not at all correct to attempt to convert a given date to a single number representing the average, the extreme, or any intermediate point in the range of error. Arnold continues, "If we have two sites dated at 3400±300 and 3800±300 years, the difference of their dates is 400±400 years, and we are justified in saying that they are 'roughly contemporary,' and that the second is 'perhaps some hundreds of years older.' If the second is shifted to 4400±300 years, the difference is 600±400 years and we can say that the second is 'probably older,' in the absence of other evidence. If it is 4600±300 years, the difference being 800±400 years, we can say 'almost certainly older,' with 19 chances out of 20 of being right. From this point the certainty of the conclusion rapidly increases." [2]The figures used in these examples were based upon the solid carbon method. The statistical principle involved is not changed by the gas counting method but the size of the counting error is reduced by a factor of four. Also, as said at the beginning, this method can now be applied to samples which are more than 40,000 years old.

As we gain experience there is a parallel increase in knowledge concerning the desired or necessary characteristics of the sample. In order to summarize some of this information Broecker and Kulp have compiled their Table 7 "Sources of Error as a Function of Sample Material." This cannot be reproduced here. The best materials now known are fresh wood, charcoal and coarse marine shell. Peat and decomposed wood are reliable but rootlets and organic intrusives must be eliminated. Fractionation might account for ± 100 years but carbon-12/carbon-13 measurements might reduce this error. The exchange of carbon atoms indigenous to the sample with modern or "dead" carbon atoms from the surrounding deposits can be checked. Similarly, the intrusion of extraneous

2. Johnson, F., 1951, "Radiocarbon Dating," pp. 58-59, *Memoir No. 8, Society for American Archaeology.*

carbon atoms can be detected. Other materials such as charred bone, both organic and inorganic, marine shell and lacustrine shell and recrystalized carbonates present various kinds of problems in dating. Some of these can be solved but the resulting dates have varying degrees of reliability. Dates on other samples are difficult or even impossible to determine, at least at present. Samples which are difficult to process must be collected with great care and given special treatment in the laboratory. They should probably not be submitted unless the possible result has particular significance and certainly not unless the laboratory is fully informed concerning the conditions under which the samples were found and collected. Sample sizes of the materials necessary for carbon-14 measurements are given as follows:

Sample Type	*Optimum Amount*	*Minimum Amount*
Calcium Carbonate	120 gm. or ¼ lb.	5 gm.
Carbon	10 gm.	0.4 gm.
Wood	50 gm.	1 gm.
Charcoal	40 gm.	1 gm.
Peat	100 gm.	2 gm.
Shell	180 gm.	8 gm.
Bone (Charred)	100 gm.	2 gm.
Bone (Uncharred)	1200 gm. or 2.5 lb.	50 gm.

Early in 1949 the method had been developed to a point where dates on samples of unknown age could be determined with some confidence. Although the major purpose was to develop the method, ten chronological problems in archaeology and geology were outlined. With the assistance of many collaborators, groups of samples from critical locations were assembled. The dates determined comprised the initial framework for a geological chronology of the northern hemisphere. Dates on earlier archaeological materials were tied into this in so far as possible. In addition, attempts were made to answer specific questions such as the age of the Hopewell and Adena cultures. A number of other samples were secured in order to determine the age of European archaeological and geological events and to confirm some estimated dates in the chronology of dynastics in ancient Egypt and the Middle East. In retrospect, the results of this initial effort are of particular interest for the research initiated a revision and consolidation of opinion concerning chronology, especially in North America.

Since the publication of the initial group of about 180 dates[3] hundreds have been added by the ten or more active laboratories. These permit correlations of the times of events in numerous regions no matter how widely separated. However, when problems are limited to the chronology of specific details of localized sequences, controversies inevitably arise. One question which has been uppermost in most of these debates has been the accuracy of the dates. Characteristic of most of the criticisms are those leveled at the method by Hunt. [4]In general his arguments did not consider well known physical opinion and in any case they have been refuted by studies of the distribution of radiocarbon in the universe. Physicists have also called attention (unpublished ?) to the fact that the difference in age between samples of wet and dry environments, which Hunt claims, requires the exchange or intrusion into the sample of actual atoms of carbon in a manner believed to be practically impossible, especially on the large scale required. Furthermore, it would require exchange of something in excess of 40% to 50% of the carbon atoms in samples to produce the alleged discrepancies between dates of dry and wet environments. Hunt has apparently made an error which is becoming less common as experience is gained. It is possible that the geological identification of the provenience of the samples may be in error and furthermore, the chronology which Hunt claims shows radiocarbon dates in wet environments to be in error is based upon unprovable opinions concerning the rates of development of geologic processes. In view of these observations, and for other reasons, we choose to ignore Hunt's arguments. However, it has been estimated that about 80% of the 378 dates determined by the Chicago laboratory are essentially correct. Some 10% of these dates may be in error because of laboratory troubles and the remaining 10% may be wrong because of improper collection, cataloguing and other "curatorial" mistakes. Suites of samples from other laboratories are probably of similar nature with the probability that as experience has been gained in the field and laboratory during the past five or more years, the proportion of erroneous dates due to technical or collection failures has been reduced.

3. Johnson, 1951, op. cit.

4. Hunt, Charles B., "Radiocarbon Dating in the Light of Stratigraphy and Weathering Processes." *The Scientific Monthly*, Vol. 81, November, 1955, pp. 240-247.

Identification of the dates which may be erroneous is a major problem. That is, some of the dates we now consider to be correct may actually be wrong and, to a lesser degree perhaps, vice versa. The major readjustments have already been made but it is likely that some more of this will eventually be done. The checking of all dates can only be done by meticluous review of laboratory procedure and reconsideration of the stratigraphy and sequence in which the samples were located. This is one reason why it is not advisable to determine a date on a sample from a single location; it cannot be checked. Unless the stratigraphic situation is very clear, which is very rare in archaeology, dates on a sequence of samples should be secured before a single number is to be fully trusted. Even if the date on a sample can be proved to be correct, it will inevitably be the subject of controversy, especially if it is a critical one. This is due to questions regarding interpretation. The significance of dated events is continually modified by discovery of new facts and the expansion of ideas.

To add to the foregoing brief description and consideration of the character of radiocarbon dating a discussion of what its development has accomplished would lengthen this article unduly. Even at its present status the method has opened up new problems for research in such fields as geochemistry and oceanography. The development of a chronology has permitted correlations of Pleistocene events in Europe and North America. In the latter continent especially, the timing of fluctuations in climate and the glacial regimen promises to provide a more comprehensive understanding of the last ice age and the periods which followed. The radiocarbon chronology has freed archaeology from a number of restrictions. The former gap believed to exist between the so-called Palaeo-Indian and the "Archaic," or whatever the succeeding stage of culture may be called, has been proved to be no gap at all. The extension backward in time of Archaic-like material and the discovery that the Palaeo-Indian material can be much later than originally thought suggests that these stages of culture may have overlapped each other for a period lasting perhaps several thousand years. It is possible, also, to see further into problems involving the origin of human culture in the New World. A date on charcoal at Tule Springs, Nevada, of "greater than B.C. 21,800" is provocative. If it can be proved that humans built the fire producing the charcoal, current speculations concerning "interstadial man" in North America will be given added impetus. The age "greater than 37,500 years" for the log presumably associated with Clovis Fluted projectile points at the Lewisville site in Texas confounds all present estimates and hypotheses concerning the origin in either the eastern or western hemisphere of the stone industry which is responsible for this kind of material. It is interesting to observe that archaeologists have matured, at least in their point of view toward radiocarbon dating, so that this date has not brought forth a peevish wail and forthright denunciation. More properly we simply look forward with some impatience perhaps either to confirmation or correction. It is recognized that this can appear either in the dating itself or in the archaeological attribution of the sample.

In the age range of about B.C. 2000 to A.D. 500 there has been great progress and a general clarification of ideas since the release of the original series of dates. This has not come about easily for many adjustments in our thinking have been necessary. These latter involve not only direct deductions and inferences, but theoretical considerations of rates of culture change, diffusion, and the like. In the Southwest, radiocarbon dates successfully overlap and support those determined by tree ring analysis. The probable confirmation of the Spinden correlation of the Maya calendar with the Julian calendar of the present day is yet to be fully substantiated. This was seriously questioned until it was found that the archaeological data could be fitted into the radiocarbon chronology without doing violence to either. Analogous adjustments have been made in the ideas concerning chronology of cultures in Peru. In the middle western United States dates are showing that Adena is older than Hopewell but that there is an overlap in time. The later group of dates is only just beginning to become useful largely because the number required to outline the chronology is relatively greater than needed for the older material. One reason for this is that the relatively large error reduces the precision of the dates and a proportionately greater number of dates is needed in order to provide an average age of a cultural level and the span of time it occupied. Such precision is necessary because by B.C. 2000 culture development was rapid and diverse and its various phases are difficult to identify precisely by available archaeological techniques. As the problems with the later dates and, as a matter of fact, older ones too, become more fully defined, one factor stands out prominently.

The usefulness of a date is in direct proportion to the data which accompanies it. It is difficult sometimes to realize that the cultural attribution of a sample is, more often than not, a very transitory opinion supported only by evidence which is circumstantial, often in the extreme. Such evidence has very little chronological validity and only in the broadest sense can it be used alone to determine the validity of a properly determined radiocarbon date. Disagreements then become a matter for careful analysis involving both the physics and the archaeology.

R. S. Peabody Foundation
Andover, Massachusetts

AN OSSEOUS FIND AT FOLLINS POND

By BERNARD W. POWELL

During the summer of 1955, while revisting Frederick J. Pohl's "Follins Pond Site"[1] on Cape Cod, I acquired a bone purportedly unearthed here. Certain speculations were then extant relating the bone to supposed Norse times on the Cape. Subsequently the bone was examined by several archaeologists at the Eastern States Archaeological Federation meeting in New Haven in the Fall. Readers who attended that meeting may recall the bone and opinions then voiced relative to it. It now seems advisable to set forth as many facts concerning this bone as I have been able to ascertain, and attempt to draw some meaningful conclusion as to the "validity" of the bone and its relative import as a find.

The bone is the cannon bone of the domestic horse *Equus*, or osteologically, the enlarged third digit metacarpal. In life this bone supports the leg from the knee or hock joint to the fetlock and is present in most hoofed quadrupeds. As seen in the accompanying illustration, a portion of the so-called splint is present on this specimen yet.[2] This is the elongated piece visible along the upper edge. It technically is termed an exostosis or bony enlargement and is common in the horse and allied animals. It is an aid to identification of such bones. As an aside, it is interesting to note the splint has a significant role in the theory of organic evolution as proof that the ancestors of *Equus* at one time possessed more than one toe.[3] In the horse today the splint is only vestigal and has no function.

This specimen was originally in the keeping of Mr. Bert Heideman, a homeowner on the western side of Follins Pond. His land is situated on a bluff overlooking the entrance of the Mill Pond creek into the upper portion of Follins Pond. This is somewhat less than a mile north of the gulley where the MAS unearthed the ship's shoring reported by Pohl.[4] Mr. Heideman's land is generally within the area that is suspect, by developers of the Norse occupancy theory, as being the site of "Leif's shelters" and/or grazing and pasturage grounds for domesticated livestock — namely cows and horses. These are well established as present in the Greenland settlements,[5] and may have possibly been brought on to Vinland during one of the voyages.[6]

Mr. Heideman recovered the bone during excavation on his land. I believe this was during actual construction of his house there. No exact provenience was recorded for the bone. It may have actually been anywhere from on the surface to some distance beneath. No further skeletal remains or other associated material seems to have been noted. Mr. Heideman showed the bone to a neighbor, Mr. Melvin B. Summerfield. Mr. Summerfield is a former student of the late Ernest Albert Hooton, Professor of Anthropology at Harvard. When he saw the bone, Mr. Summerfield suspected it to be the cannon bone of a horse. He knew generally of speculation relating this region of Cape Cod to the Vinland of the Norse. He sent the bone to Dr. Hooton and received a reply to this effect ". . . confirmed the fact that this bone was the canon (sic) bone of a small horse and agreed with me that its condition indicated an age of 900-1000 years."[7] Mr. Summerfield further informs me that Dr. Hooton agreed with him that ". . . the Norsemen brought small horses with them . . .".[8]

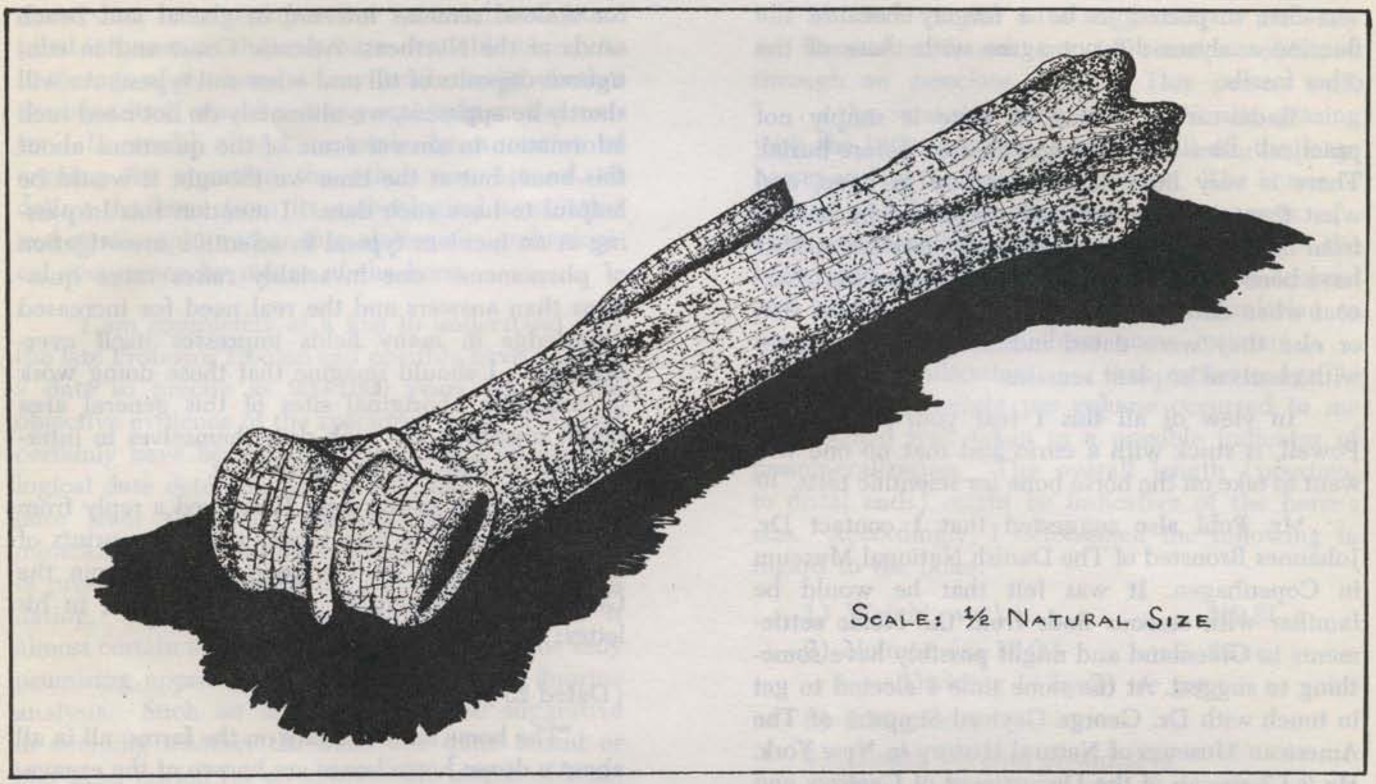
The correspondence from Dr. Hooton in regard to this specimen is no longer extant. It is my belief

1. Pohl, F. J., 1952, p. 68.

2. Romer, A. S., 1947, p. 385.

3. Romer, A. S., 1941, p. 143.

4. Pohl, F. J.



that both Mr. Heideman and Mr. Summerfield relate truthfully their recollections of this communication with Dr. Hooton. Both gentlemen are of the highest caliber and I know of no reason to disbelieve them. However, it is indeed unfortunate that the original letters pertaining to this have been misplaced or destroyed, for all of us would like to know how Dr. Hooton arrived at (his supposed) dating for the age of the bone . . . .

Mr. Heideman gave the bone to me to see if I could develop anything further in regard to it. The bone at once struck me as well preserved, was rather hard, and apparently quite heavy. These latter two factors suggested at least partial permineralization of the bone to me, and—barring other circumstances—might mean that the bone was indeed rather old.

Subsequently I contacted Mr. Pohl in New York and informed him of what I had been told about the bone. He was of the opinion that the Vikings brought at least a few horses out from Greenland with them.[9] He in turn contacted Dr. Edward S. Deevey of the Geochronometric Laboratory at Yale as to the likelihood of a C-14 dating for the bone. Dr. Deevey, incidentally, is testing some of the ship's shoring with an ultimate view towards dating it if possible. Some time later Dr. Deevey replied to Mr. Pohl as follows:

"As to the horse bone that you describe, it is very hard for me to understand the chronological problem, since I cannot imagine what basis Professor Hooton could have had for his estimate of age from the bone itself. If the horse was a native American horse it clearly could not have been older than 1521 A.D.—that is, unless you think the Norsemen brought horses to America with them. If the horse was native, no date younger than about 8000 B.C. would be guessed by a paleontologist, but in any case no 'test' of the bone itself could give the age correctly. Some bones have been dated in a relative sense by the fluorine method, but this tells us only whether one fossil in a deposit is of the same age as the others or is perhaps intrusive. By this method Swanscombe man was shown to be contemporary with the other vertebrates in the same deposit, whereas Piltdown man

5. Degerbol, M., 1936, p. 13.

6. Personal communication with Mr. Pohl.

7. Personal communication with Mr. Summerfield; quoted material is from *his* letter.

8. Ibid.

was first suspected to be a forgery because the fluorine analyses did not agree with those of the other fossils.

"Radio-carbon dating of bone is simply not practical unless the bone was charred before burial. There is very little organic carbon in bone, and what there is is far too easily replaced by carbon from the ground water after burial. Any bones that have been 'dated' by radio carbon were either charcoal when dated, as in the case of the Folsom site, or else they were dated indirectly by association with charcoal or plant remains.

"In view of all this I fear your friend, Mr. Powell, is stuck with a curio and that no one will want to take on the horse bone for scientific tests."[10]

Mr. Pohl also suggested that I contact Dr. Johannes Bronsted of The Danish National Museum in Copenhagen. It was felt that he would be familiar with osseous finds from the Norse settlements in Greenland and might possibly have something to suggest. At the same time I elected to get in touch with Dr. George Gaylord Simpson of The American Museum of Natural History in New York. He is Chairman of the Department of Geology and Paleontology; and is perhaps our country's leading paleontologist and an avowed authority on horses.[11] Certainly his opinion regarding this bone is most valuable.

A reply from Dr. Bronsted referred me to Dr. Magnus Degerbol of the Zoologisk Museum in Copenhagen. He has published several items pertaining to osseous material from the settlements in Greenland. I therefore wrote him explaining our problem and asking for his assistance.

Meanwhile at the Eastern States Archaeological Federation annual meeting in New Haven in the Fall, the bone was examined by several archaeologists on the spot. Some were of the opinion that the bone "was quite old" and deduced this mainly from the heaviness of the bone mentioned previously. These opinions were, I realize, only "off-the-cuff" but it is interesting that comments were passed *before* the group was told speculations relating to the age of the bone. Several present, familiar with the usual condition of dated osseous material from aboriginal times on Cape Cod and peripheral areas in Massachusetts, said they had never encountered a bone so apparently fossilized. Their consensus was to follow-up whatever might develop and see what we could find. Incidentally, I was unable to secure data on possible rates of permineralization for skeletal remains interred in glacial and beach sands of the Northeast Atlantic Coast and in contiguous deposits of till and other soil types. As will shortly be apparent, we ultimately do not need such information to answer some of the questions about this bone, but at the time we thought it would be helpful to have such data. I mention this in passing as an incident typical in scientific investigation of phenomena: one invariably raises more questions than answers and the real need for increased knowledge in many fields impresses itself everlastingly. I should imagine that those doing work in coastwise aboriginal sites of this general area might sometime use such data themselves in interpreting partially mineralized finds.

In January of this year I received a reply from Dr. Degerbol. He very kindly sent me reprints of his several works on the bone material from the Greenland settlement.[12] He says, in part, in his letter:

(Dated 25 January 1956)

"The horse has been rare on the farms; all in all about a dozen horse bones are known of the excavations in (the) West and East settlements, although thousands of other bones are known. These bones have been those of a small horse, in size resembling an Iron Age horse from Nydam bog[13], 3 or 4 Cent. A.D., set up in the Zoological Museum. The shoulder height from the uppermost spinal process on this animal is 127 cm. The length, from the foremost part of the head hanging obliquely downwards is about 2 m. The length of the whole metatarsal bone is 260 mm, on the Nydam horse 255; the medial breadth is 28 and 29 mm respectively."

I should like now to quote at some length from the correspondence with Dr. Simpson.

(Dated 7 November 1955)

"We will be glad to look at your horse bone and to give an opinion on it, but frankly I am extremely doubtful as to whether our opinion will be of any real use to you. It is not likely that we could do any more than confirm what is apparently already well established, that the bone belonged to a domesticated horse. Running a single bone down to its exact race or breed would require a

9. Personal communication with Mr. Pohl.

10. Personal communication with Mr. Pohl; quoted from original letter in his possession.

11. See his *Horses* (Oxford University Press, New York, 1951).

great deal more comparative material and compiled information than we have available here. As to the age of the bone, I very much doubt whether the bone itself would cast any real light on the matter. It would almost certainly be a matter of arguing the question the other way around, of dating the bone from its archeological association and stratigraphy rather than dating the archeological occurrence by means of the bone.

"I am completely at a loss to understand how the late Professor Hooton can possibly have reached a date so precise as 900-1000 years ago on the objective evidence of the specimen itself. He must certainly have been taking for granted an archeological date determination rather than supplying a date from the bone itself. The heaviness or mineralization of the bone would not on the basis of present knowledge permit one to provide such a dating. Apart from the morphology, which is almost certain to be inconclusive as to age, the only promising approach would seem to be a fluorine analysis. Such an analysis would be suggestive in deciding whether the bone was quite recent or had been buried for an appreciable length of time, but it still would not make it possible to say how great a length of time in any very close way unless many further data are available for buried bones in Greenland. Unfortunately also we do not ourselves have the means for making fluorine analyses."

(Dated 27 January 1956)

"Now my scientific assistant Mrs. Patsuris and I have looked over the specimen with some care and made such comparisons as are possible to us here. Unfortunately the skepticism expressed in my letter of 7 November 1955 proves to be quite justified. The bone is certainly that of a horse of the genus *Equus* and almost certainly from a rather light domesticated horse. We see no characters that would differentiate it from any common horse of approximately this size. It is just possible, but still not probable, that a closer identification could be made if we had good biometric or statistical data on dated samples of horse populations, but we simply do not have such data and I do not know where they might be available.

"As far as I can see it is absolutely impossible at present to date this specimen on the basis of the bone itself. In the geological sense of the word it is doubtless recent or Holocene, but that covers a lot of time and is of no particular value to you."

Mr. Pohl passed on a suggestion to me early in December based on information obtained through an associate of his. This person said, " . . . the semi-starvation diet in Nordic grazing with the little sunshine, tends to kill off the large horses and let the small ones survive. The horses of Iceland and Norway are small. He suggests . . . exact measurements, and also exact weight (of the bone) and send these data to museums in Iceland and Norway. Perhaps . . . weight in relation to size . . . scholars . . . form some estimate . . . amount of fossilization . . . thus estimate age."[14] The factor of weight per volume occurred to me and seemed well taken as a possible indicator of permineralization. The overall length (proximal to distal ends) might be indicative of the horse's size. Accordingly, I determined the following in regard to the bone:

1) Weight wet) .... 389.81 g
2) Volume (in H_2O) .... 252 cc
Dividing 1) by 2) we get
3) 1.54 g/cc
4) Length (overall proximal to distal ends .... 266 mm

The heaviness of the bone and the 'accepted' fossilization thereof prompted my curiosity. I therefore sectioned the bone on a diamond saw. A cut was made on an angle of about 30° in about 25 mm from the distal end. Subsequent grinding, lapping and polishing operations revealed a significant fact: *the bone is not fossilized!* The soaking it had undergone in the water while taking the weight and volume readings had perceptibly softened this otherwise quite hard bone and the interior cells did not show filling or replacement with a hard, heavy mineral of any kind. We had expected at least some fossilization but I would state now that the bone is not fossilized at all. I then thought the marked heaviness of the bone might be mud, silt or other material which had possibly been carried through minute cracks into the interior of the bone and there deposited in the cellular interstices. This is not the case, either. If the bone is unduly heavy (and significantly Dr. Simpson does not mark this), then it is not from replacement with heavy mineral.

As a follow-up I once again contacted Dr. Simpson in regard to the value of determining the

12. See appended bibliography.

13. I believe this refers to a site somewhere in northern Europe.

g/cc factor for the bone. I received a reply as follows:

(Dated 12 March 1956)

"I am afraid that I must fail you once more. I do not have any data on the specific gravity of horse cannon bones and I think that any fairly significant data would involve very elaborate research. The bone is of course not a homogenous substance with a fixed and determinable specific gravity. The outer layers of the cannon bone are very dense whereas the inner layers are quite porous and open. The overall specific gravity of the cannon bone would depend in a very elaborate way on the proportions and intergradation of these two parts and any figure would be meaningless for comparison unless it applied to bones of exactly the size and proportions of your bone and also took into consideration the undoubtedly great variation involved. I am fairly sure that no one has ever gathered such data and I am not at all sure that the materials necessary for working out the relationships are available."

In summation, then, it appears established that the bone per se is:

1) not objectively datable from itself
2) is not fossilized
3) has no recorded associated remains of either skeletal or artifact-like nature
4) has no recorded provenience

Such serious defects remove the bone from further consideration as a "dated" Norse Age find. Some might argue that:

1) Nordic horses were light-boned; specimen is from a light animal
2) horses were present in Greenland (though rare)
3) horses *may* have been brought on to Vinland (I know of no direct reference)
4) a prominent scientist is reputed to have said the bone in question was 900-1000 years old (no documentation for this—only secondary recollection)

It is at once apparent that this is no really substantial ground on which to postulate that the bone represents remains of an animal brought to North America by Vikings in the 11th century. On the basis of present knowledge we can no longer entertain this find as evidence for the presence of Norsemen on Cape Cod.

14. Personal communication with Mr. Pohl.

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Attleboro, Mass.

Swanson, Mrs. W. B.
29 Poquanticut Avenue
Easton, Mass.

Taylor, Mrs. J. E.
26-A Water Street
Woburn, Mass.

Taylor, Mrs. W. H.
1 Vernon Street
No. Middleboro, Mass.

Teger, Mrs. J. A.
Old Sudbury Road
Wayland, Mass.

Tetreault, Mrs. Henry
37 Fales Street
Central Falls, R. I.

Thomas, Mrs. Walter, Jr.
15 Oxford Street
Fairhaven, Mass.

Thomson, Mrs. F. L.
34 Wilbur Avenue
No. Dartmouth, Mass.

Tufts, Mrs. E. E.
41 Payson Street
Attleboro, Mass.

Turberg, Mrs. P. J.
R.F.D. 1 Main Street
Lakeville, Mass.

Turner, Mrs. C. H.
Keith Avenue
Lakeville, Mass.

Vossberg, Mrs. W. A.
25 Tomahawk Drive
Tewksbury, Mass.

Waring, Anthony A.
132 Bay Point
So. Swansea, Mass.

Waring, Mrs. E. A.
132 Bay Point
So. Swansea, Mass.

Waring, Mrs. O. J.
3313 Riverside Avenue
Somerset, Mass.

Whiting, Mrs. A. P.
163 Sandwich Street
Plymouth, Mass.

Whiting, Mrs. W. C.
Blodgett Avenue
Duxbury, Mass.

Whittaker, Mrs. James
323 County Street
New Bedford, Mass.

Wilder, Mrs. D. C.
86 Brewster Avenue
So. Braintree 85, Mass.

Wing, Mrs. H. C., Jr.
62 Pierce Street
Greenfield, Mass.

Wood, Mrs. E. R.
East Main Street
Norton, Mass.

Wright, Mrs. E. M.
Oliver Street
Middleboro, Mass.

Zenker, Mrs. Karol R.
47 Halcyon Road
Newton Centre, Mass.

JUNIOR MEMBERS

Andersen, Harry G.
20 Front Street
Walpole, Mass.

Andersen, Miss Jean
20 Front Street
Walpole, Mass.

Andersen, John
20 Front Street
Walpole, Mass.

Baker, Noel B.
2548 G.A.R. Highway
Swansea, Mass.

Broman, Donald W. Jr.
134 Brookside Avenue
Brockton, Mass.

Bruso, Robert D.
72 Allen Street
Randolph, Mass.

Buker, Miss Christine
43 Francis Avenue
W. Bridgewater, Mass.

Buker, Miss Sally
43 Francis Avenue
W. Bridgewater, Mass.

Buker, Miss Susan
43 Francis Avenue
W. Bridgewater, Mass.

Burtt, J. Frederic, Jr.
97 Hoyt Avenue
Lowell, Mass.

Carroll, M. Emmett
Chilmark, Mass.

Clark, Francis
879 Main Street
So. Weymouth, Mass.

Chase, H. Curtis
43 White Avenue
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DeRose, William E.
131 Meridian Street
Greenfield, Mass.

Dryden, John
3 Budreau Avenue
Millbury, Mass.

Engstrom, Peter A.
546 N. Central Street
East Bridgewater, Mass.

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Scorton Neck
East Sandwich, Mass.

Goff, Miss Lynda
336 Old Colony Avenue
Somerset, Mass.

Goff, Miss Sherry
336 Old Colony Avenue
Somerset, Mass.

Giusti, Paul A.
Sunset Lane
So. Dartmouth, Mass.

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30 Puritan Road
Buzzards Bay, Mass.

Hayes, John L.
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So. Dartmouth, Mass.

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Hunt, David
2 Alice Walk
Hingham, Mass.

Lally, David
51 Carmel Circle
Bridgewater, Mass.

Lally, Donna
51 Carmel Circle
Bridgewater, Mass.

JUNIOR MEMBERS

Laviolette, Richard
17 Reynolds Street
New Bedford, Mass.

Lemaitre, Charles
103 West Street
Ware, Mass.

Lodi, Edward J., Jr.
Parkwood Beach
Wareham, Mass.

Petersen, Kurt
4 Cottage Street
Marion, Mass.

Puchala, Paul
1580 Plainville Road
New Bedford, Mass.

Raposa, Miss Bonnie
R.F.D. No. 1
Westport, Mass.

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332 So. Main Street
Bel Air, Md.

Robinson, Miss Elizabeth A.
332 So. Main Street
Bel Air, Maryland

Robinson, Miss Lorna L.
332 So. Main Street
Bel Air, Md.

Sargent, Lyman T.
940—6th Avenue S. E.
Rochester, Minnesota

Stewart, John A.
45 Rockland Street
So. Dartmouth, Mass.

Sutton, Peter J.
31 Pershing Avenue
Seekonk, Mass.

Thomson, Miss Donna L.
34 Wilbur Avenue
North Dartmouth, Mass.

Wing, Donald
62 Pierce Street
Greenfield, Mass.

INSTITUTIONAL MEMBERS

Attleboro Public Library
Attleboro, Mass.

Bangor Public Library
Bangor, Maine

Library, Bryn Mawr College
Bryn Mawr, Pa.

Library, Chicago National Historical Museum
Roosevelt Road and Lake Shore Drive
Chicago 5, Illinois

Children's Museum
c/o Mrs. Bertha Waldo
Dartmouth, Mass.

Libraries, Columbia University
New York 27, New York

Cornell University Library
Periodicals Department
Ithaca, N. Y.

Cranbrook Institute of Science
Bloomfield Hills, Mich.

Thomas Crane Public Library
P.O. Box 379
Quincy 69, Mass.

Library, Dartmouth College
Hanover, N. H.

Dukes County Historical Society
Edgartown, Mass.

Library, Emory University
Emory University, Ga.

Free Public Library
Worcester 8, Mass.

Fruitlands Museum
Prospect Hill
Harvard, Mass.

Haverhill Historical Society
240 Water Street
Haverhill, Mass.

Haverhill Public Library
Haverhill, Mass.

John Woodman Higgins Armory
100 Barber Avenue
Worcester 6, Mass.

Holyoke Public Library
Holyoke, Mass.

Huntington Free Library and Reading Room
9 Westchester Square
New York 61, New York

Library, American Museum of National History
Central Parkway W. at 79th Street
New York 24, N. Y.

Library, Indiana University
Bloomington, Ind.

Museum of Science Library
Science Park
Boston 14, Mass.

Library, National Museum of Canada
National Museum Building.
Ottawa 4, Ontario, Canada

Meader, Prof. R. F. W.
Susquehanna University
Selinsgrove, Pa.

Newberry Library
60 W. Walton Place
Chicago 10, Illinois

Old Dartmouth Hist. Society
P.O. Box 318
New Bedford, Mass.

Ontario Archaeological Society
174 Lee Avenue, Toronto 8, Ont., Canada
Miss G. Ruth Marshall, V. Pres.

Peabody Museum Library
Harvard University
Cambridge 38, Mass.

R. S. Peabody Foundation
Andover, Mass.

Peabody Museum of Salem
161 Essex Street
Salem, Mass.

R. I. Hist. Society
52 Power Street
Providence 6, R. I.

Royal Ontario Museum of Archaeology
100 Queen's Pk.
Toronto 5, Ontario, Canada

San Diego Scientific Library
Balboa Parkway
San Diego, Calif.

Sherman Sporting Camps
Norris Street
Greenville, Maine

Library, Smithsonian Institution
Washington 25, D. C.

State Historical Soc. of Wisconsin
816 State Street
Madison 6, Wisconsin

Library, Yale University
New Haven, Conn.

Witthoft, Mr. John
Pennsylvania State Museum
Harrisburg, Penn.

Gen'l Library, University of Calif.
Serials Department
Berkeley 4, Calif.

Library, University of California
405 Hilgard Avenue
Los Angeles 24, Calif.

Library, University of Chicago
Periodical Sec., 5801 Ellis Avenue
Chicago 37, Illinois

Library, University of Denver
Serials Div., Denver 10, Colo.

Library, University of Kansas
Periodical Department
Lawrence, Kansas

Libraries, University of Kentucky
Lexington 29, Kentucky

Gen'l Library, University of Michigan
Ann Arbor, Michigan

Library, University of Minnesota
Minneapolis 14, Minn.

Library, University of Missouri
Columbia, Mo.

Library, University of New Mexico
Albuquerque, N. M.

Library, University of Pennsylvania
34th Street and Woodlawn Avenue
Philadelphia, Pa.

Library, University of Texas
Serials Acquisition
Austin 12, Texas

Library, University of Utah
Salt Lake City 1, Utah

EDITORIAL COMMENT . . . .

With this issue your new and fourth Editor assumes the role and the responsibilities entailed, well aware of the high standards attained by his predecessors. Our Bulletins have been of great value to the individual members, and have been well-received by our considerable and growing list of institutional subscribers.

Needless to say, we will bend every effort to maintain and strengthen the quality of this publication, but this end can only be attained through the active cooperation of all of our members.

In looking over some of our early issues, when our membership numbered no more than fifty or sixty, we note at once the variety of the subject matter and the excellence with which it was presented. This early and enthusiastic group presented no problem in production. We now comprise better than six hundred members, the majority of whom have yet to see their names in print. They must certainly have acquired valuable information in our field which should see the light of day.

It is not essential to arrive at learned conclusions regarding material encountered. A bare statement of facts can later be compared with other knowledge and correlated into an accurate observation for the region. Be assured that material submitted will not lose its individuality through editing, and do not fear criticism or differences of opinion — through such means we arrive at the truth. We need a constant flow of material for publication through the cooperative effort of our entire personnel. Only in this manner can we maintain our position in the field.

Funds are now in hand for a resumption of the News Letter, and a mimeographed issue will be distributed in the near future. It will include the complete By-Laws of the Society; and will resume its coverage of Trustee and Society meetings, news of the Chapters when available, and our latest statement of condition. Communications from members will also be printed, space permitting.

Our basic active membership fee of three dollars per annum has remained constant through the years. Over this period we have encountered a gradual and steady rise in printing and other costs; and, at this time, we suggest that more members give serious consideration to entering our contributing or sustaining groups. This will help to obviate any possible future consideration of a higher scale of the basic dues.

HERE AND THERE

Reproduction of a small Indian village is planned as an added feature in the reconstruction of "Plimoth Plantation" as it appeared in the early 17th century at Plymouth, Mass. It will be located near the replica of the Mayflower. Our Historical Research and Excavation committees have furnished data for this project.

The use of red ochre by the aborigines on ceremonial and other occasions has been found to be nearly universal. Now the early fluted point or blade is being encountered in widely scattered areas. These projectile forms have been found not only in the southwest and the plains states, but in Massachusetts, Pennsylvania, Virginia, Kentucky and Alabama. This incidence would seem much too widespread to indicate trade goods interrelationships, and implies a pre-Archaic complex in the various areas.

Society members will be able to further their education this fall and winter without leaving their living rooms. The first "live" television classroom can be seen over WGBH-TV, Channel 2, in a University Extension course at Harvard. The class is on arts and crafts of primitive peoples, and is being taught by Dr. John O. Brew, director of Harvard's Peabody Museum of Archaeology and Ethnology, Monday evenings at eight.

A novel restoration technique is being used by Amedeo Maiuri at Pompeii, in Italy. The eruption of Vesuvius, which occurred in August, 79 A.D., found many of the inhabitants fleeing from the city toward the sea. Petrified ash shells of some of the victims, noted by depressions, have been uncovered since 1860. Formed by the gradual decay of the body inside its ash wrappings, the shells retain a negative impression of the enclosed figure. Archaeologist Maiuri has accurately reconstructed several victims by drilling a number of holes through the ash stratum and pouring thinned plaster of paris into the cavity. After allowing the plaster to harden, the surrounding ash is carefully chipped away and the eruption victims are reconstructed with such accuracy that even the minutely defined arm and leg muscles are revealed.

Recently published and worthy of study is a book titled "From the Tablets of Sumer," by Samuel Noah Kramer. Descriptive of a civilization which flourished 5,000 years ago in Mesopotamia, as translated from clay tablets, Professor Kramer credits the Sumerians with the first schools, the first historian, the first pharmacopoeia, and the first development of an effective system of writing—in short, the earliest picture we have of a major civilization.